

MAPELASTIC GUARD ZERO

Two-component, flexible cementitious mortar for protecting large concrete structures subject to high stress



CO₂ FULLY OFFSET PRODUCTS

Mapelastic Guard Zero is part of the CO₂ Fully Offset in the Entire Life Cycle line of products. CO₂ emissions measured throughout the life cycle of products from the Zero line in 2024 using Life Cycle Assessment (LCA) methodology, have been offset through the acquisition of certified carbon credits in support of forestry protection projects. A commitment to the planet, to people and to biodiversity. For more details on how emissions are calculated and on climate mitigation projects financed through certified carbon credits, visit the webpage zero.mapei.com.

WHERE TO USE

Protecting concrete structures against aggressive atmospheric agents.

Some application examples

- Protection for structures with insufficient concrete cover around steel reinforcement.
- Protecting concrete piles and decks on road and railway viaducts from carbon dioxide penetration.
- Protecting concrete surfaces that come into contact with seawater, de-icing salts such as sodium chloride and calcium and sulphate salts.
- Protecting concrete with cracks caused by shrinkage to block the penetration of water and aggressive agents present in the atmosphere.
- Flexible skimming layers on concrete structures with thin sections, including those subject to small deformations when under load (for example prefabricated elements).

TECHNICAL CHARACTERISTICS

Mapelastic Guard Zero is a two-component, flexible, light grey mortar made from cementitious binders, fine-grained selected aggregates, special additives and synthetic polymers in water dispersion according to a formula developed in the MAPEI Research & Development Laboratories.

When the two components are mixed together, a free-flowing mix is obtained which may be applied at thicknesses up to 2 mm, including on vertical surfaces. Thanks to its high content of quality synthetic resins, the hardened layer of **Mapelastic Guard Zero** maintains its flexibility under all environmental conditions, and is totally impermeable to water at pressures up to 1.5 atmospheres and the penetration of de-icing salts, sulphates, chlorides and carbon dioxide.

Mapelastich Guard Zero also has excellent adhesion on all concrete surfaces, provided that they are sound and sufficiently clean. These properties, together with its excellent resistance to U.V. rays, ensures that structures protected with **Mapelastich Guard Zero** are durable, even when located in areas with particularly cold climatic conditions, in coastal areas with a saline-rich atmosphere or in industrial areas where the air is highly polluted. **Mapelastich Guard Zero** complies with the principles defined in EN 1504-9 ("*Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity - General principles for the use of products and systems*") and the minimum requirements of EN 1504-2 coating (C) according to principles PI, MC and IR ("*Surface protection systems for concrete*").

RECOMMENDATIONS

- Do not use **Mapelastich Guard Zero** for thick coatings.
- Do not apply **Mapelastich Guard Zero** at temperatures below +8°C.
- Do not add cement, aggregates or water to **Mapelastich Guard Zero**.
- Protect from rain and accidental spillages of water for the first 24 hours after application.

APPLICATION PROCEDURE

TECHNICAL INFORMATION FOR THE APPLICATION

Mixing ratio:	component A : component B = 3 : 1 (one 24 kg bag of component A with an 8 kg can of component B)
Thickness applied:	final thickness at least 2 mm (see <i>product application section</i>)
Application temperature range:	surrounding and substrate temperature from +5°C to +35°C
Pot life of mix:	60 mins. (at +20°C)

Preparation of the substrate

The surface to be treated must be sound, perfectly clean, without cement laitance, loose and crumbling parts. Traces of dust, grease, oil and form release agents must be removed by hydro-sandblasting or with high-pressure water jets.

If the structure to be protected with **Mapelastich Guard Zero** is deteriorated, proceed as follows:

- remove all deteriorated and loose concrete to obtain a sound, strong, rough substrate. Any areas previously repaired and which are not bonded must be removed; the damaged parts must be removed by manual or mechanical abrading, or by hydro-demolition or hydro-scarifying. The last two techniques require the use of high-pressure water. They are particularly recommended because they do not damage the reinforcing steel and structures are not subject to vibrations that could provoke the formation of micro-cracking in the surrounding concrete;
- after preparation, the surface of the substrate must have an irregular finish with at least 5 mm roughness;
- remove all dust, rust, cement laitance, grease, oil and old paint from the concrete and reinforcing steel by hydro-sandblasting;
- treat reinforcing steel with **Mapefer** or **Mapefer 1K Zero**, according to the procedure illustrated in the relative technical data sheet for each product;
- wait until **Mapefer** or **Mapefer 1K Zero** has dried;
- saturate the substrate with water;
- before reintegrating the area wait until any excess water has evaporated off to leave a saturated substrate with a dry surface (s.s.d. condition). If necessary, use compressed air to help remove excess water;
- repair the concrete using a shrinkage-compensating mortar from the **Mapegrout** or **Planitop** ranges.

Preparation of the mortar

Pour component B (liquid) into a suitable clean container and slowly add component A (powder) while stirring with a mixer. Carefully mix **Mapelastich Guard Zero** for several minutes, making sure no powder remains attached to the sides or bottom of the container. Keep mixing until completely blended. A mechanical mixer at low speed is recommended for this operation, to prevent entraining too much air into the mix. Avoid mixing the product manually.

Mapelastic Guard Zero may also be prepared with a paddle mixer fitted with an attachment suitable for mixing mortar. It is recommended to check the mortar is evenly mixed and that there are no lumps before pouring it into the hopper of the pump.

The pot life of **Mapelastic Guard Zero** is approximately 1 hour at +20°C.

The instructions for the preparation of the mortar to be used for the creation of concrete samples for laboratory tests are reported in the "Technical Data" table.

Manual application of the mortar

Skim the damp, prepared surface to a feather edge with a thin layer of **Mapelastic Guard Zero** with a smooth trowel then, while still fresh, apply a second layer to form a total thickness of at least 2 mm. For structures with micro-cracks or structures that are particularly stressed, we recommend embedding **Mapenet 150** with a mesh size of 4.5 x 4 mm in the first layer of **Mapelastic Guard Zero** to reinforce the mortar (refer to the technical data sheet for **Mapenet 150**). After embedding the mesh, finish off the surface with a flat trowel and apply the second layer of **Mapelastic Guard Zero** when the first layer has hardened (after 4-5 hours). Take special care around expansion and structural joints and in irregular areas subject to high dynamic stress by applying **Mapeband TPE** tape made from thermo-plastic polymers and synthetic elastomers.

After applying **Mapelastic Guard Zero**, the structure may be further protected by applying a coloured acrylic resin-based finishing product in water dispersion from the **Elastocolor** range. The products from the **Elastocolor** range are available in a wide range of colours using the **ColorMap®** automatic colouring system. When completely dry, they form an elastic coating which is impermeable to water and aggressive agents present in the surrounding environment (CO₂ - SO₂), while remaining permeable to vapour. Apply the elastic coating at least 7 days after application of **Mapelastic Guard Zero**. In good weather and at the right temperature, this period may be reduced to 3 days.

Spray application of the mortar

Apply **Mapelastic Guard Zero** on the damp surface prepared as specified by spray using a worm-screw type rendering machine with a separate feed hopper, and a lance specific for fine grade materials with a 6 to 10 mm spray nozzle connected to a compressor with a capacity of at least 1000 litres/minute at 4-5 bar.

The product is not compatible with continuous-feed rendering machines.

For further information on which equipment to use please contact our Technical Services – Building Operations Department.

Apply a layer of **Mapelastic Guard Zero** at least 2 mm thick. To achieve a more even surface, we recommend applying **Mapelastic Guard Zero** in 2 layers. Apply successive layers when the previous layer has dried (after 4-5 hours). In areas with micro-cracks or which are particularly stressed, we recommend embedding **Mapenet 150** with a mesh size of 4.5 x 4 mm in the first layer of **Mapelastic Guard Zero** while still fresh.

Smooth over **Mapelastic Guard** with a flat trowel immediately after embedding the mesh. If the mesh needs to be covered even more, apply another layer of **Mapelastic Guard Zero** by spray.

Take special care around expansion and structural joints and in irregular areas subject to high dynamic stress by applying **Mapeband TPE** tape made from thermo-plastic polymers and synthetic elastomers. After applying **Mapelastic Guard Zero**, the structure may be further protected by applying a coloured acrylic resin-based finishing product in water dispersion from the **Elastocolor** range. The products from the **Elastocolor** range are available in a wide range of colours using the **ColorMap®** automatic colouring system. When completely dry, they form an elastic coating which is impermeable to water and aggressive agents present in the surrounding environment (CO₂ - SO₂), while remaining to vapour. Apply the elastic coating at least 7 days after **Mapelastic Guard Zero**. In good weather and at the right temperature, this period may be reduced to 3 days.

PRECAUTIONS TO BE TAKEN DURING AND AFTER APPLICATION

No particular precautions need to be taken if the temperature is around +20°C.

In hot weather, we recommend avoiding exposure of the material to the sun before use (powder and liquid).

In particularly dry, warm or windy weather, protect the surface with sheets after applying the product to prevent rapid evaporation.

PERFORMANCE DATA

Thanks to its crack-bridging capacity, **Mapelastic Guard Zero** protects concrete structures against the formation of cracks generated by dynamic loads, shrinkage, temperature variations, etc., even in particularly rigid weather conditions.

Also, according to tests carried out by external laboratories as described below, results show that **Mapelastick Guard Zero** is highly resistant to chemical aggression and offers efficient protection for concrete against the penetration of CO₂ (carbonation) and chlorides.

Both types of aggression trigger off corrosion in reinforcing steel resulting in a loss in structural integrity. Carbon dioxide (CO₂) penetrates into the concrete at a parabolic rate:

$$x = K \cdot t^{1/2}$$

where:

x is the thickness of concrete penetrated by CO₂

K is the diffusion coefficient of CO₂

t is the period of exposure to an atmosphere containing CO₂

The value of K depends mainly on the characteristics of the concrete (type of cement, additives where applicable, water/cement ratio, curing time, etc.) and environmental factors (humidity, temperature, concentration of CO₂, etc.), and must be determined experimentally, therefore, for each case.

Tests carried out by *Società Autostrade per l'Italia* (Italian Motorways Society) research laboratories have measured the value of the diffusion coefficient K on concrete with water/cement ratios of 0.5 and 0.6.

Results gave an average K value of 7.6 for concrete with a water/cement of 0.5, and of 8.0 for concrete with a water/cement ratio of 0.6.

If we assume a thickness of concrete cover of x = 30 mm and these values are applied in the formula $x = K \cdot t^{1/2}$, we get:

$$t_{concrete} = 900 \text{ mm}^2 / (57.76 \text{ mm}^2 \cdot \text{year}^{-1}) \sim 15.6 \text{ years for concrete with a water/cement ratio of 0.5}$$

$$t_{concrete} = 900 \text{ mm}^2 / (64 \text{ mm}^2 \cdot \text{year}^{-1}) \sim 14 \text{ years for concrete with a water/cement ratio of 0.6}$$

where t represents the time required for carbonation to penetrate through all the concrete cover.

The same tests were carried out on concrete samples protected with **Mapelastick Guard Zero**, and the results showed K values of 0.25 to 0.29. If we assume an average K value for **Mapelastick Guard Zero** of 0.27 (mm · year^{1/2}) and then use the formula:

$$x = K \cdot t^{1/2}$$

where x is the thickness of **Mapelastick Guard Zero** equal to 2 mm, we can calculate that, by applying **Mapelastick Guard Zero** on the surface of concrete, it is possible to increase the durability of structures by providing an efficient barrier to the penetration of CO₂ to more than 50 years.

As far as aggression from chlorides is concerned, according to the Danish certification body COWI (Consultancy within Engineering, Environmental Science and Economics), a 2.5 mm thick layer of **Mapelastick Guard Zero** corresponds to 30 mm of concrete cover made from concrete with a water/cement ratio of 0.45.

CLEANING

Because of the high adhesion of **Mapelastick Guard Zero**, including on metals, we recommend cleaning tools with water before the mortar starts to set. Once hardened, cleaning must be carried out mechanically.

CONSUMPTION

Manual application:

- approximately 1.7 kg/m² per mm of thickness.

Spray application using a rendering machine:

- approximately 1.85 kg/m² per mm of thickness on a flat surface
- approximately 2.2 kg/m² per mm of thickness on a rough surface with irregularities

PACKAGING

32 kg kits:

component A: 24 kg bags;

component B: 8 kg cans.

STORAGE

Mapelastick Guard Zero component A may be stored for 12 months in its original packaging in a dry place.
Mapelastick Guard Zero component B may be stored for 24 months.
Store Mapelastick Guard Zero in a dry place at a temperature of at least +5°C.

SAFETY INSTRUCTIONS FOR PREPARATION AND APPLICATION

Instructions for the safe use of our products can be found on the latest version of the Safety Data Sheet, available from our website www.mapei.co.uk.
PRODUCT FOR PROFESSIONAL USE.

TECHNICAL DATA (typical values)

PRODUCT DETAILS

in compliance to UKCA EN 1504-2

Classification according to EN 1504-2: (methods and principles)	Coating (C) – principles PI, MC and IR	
	Component A	Component B
Consistency:	powder	liquid
Colour:	light grey	white

TECHNICAL INFORMATION FOR PRODUCT PREPARATION

Mixing ratio:	component A : component B = 3 : 1
Preparation of mix:	mix with a low-speed mixer for approx. 1' 30" until an even mix with the declared density is obtained

CHARACTERISTICS OF FRESH MIX (at +20°C - 50% R.H.)

Colour of the mix:	light grey
Consistency of the mix:	plastic-trowellable
Density of the mix:	1650 kg/m ³

FINAL PERFORMANCE

*Curing at +23°C – 50% R.H. unless otherwise specified by the test methods
(dry thickness 2.0 mm)*

Performance characteristic	Test method	Requirements according to EN 1504-2 (C) MC and IR	Product performance
Direct tensile adhesion to concrete:	EN 1542	flexible systems with no traffic ≥ 0,8 MPa	1.0 MPa
Thermal compatibility - freeze/thaw cycles with de-icing salts (50 cycles) following storm cycles (10 cycles)	EN 13687-1 EN 13687-2	flexible systems with no traffic ≥ 0.8 MPa	≥ 0.8 MPa
Direct tensile adhesion to concrete (after 7 days at +20°C and 50% R.H. + 21 days in water):	EN 1542	not required	0.6 MPa
Elasticity expressed as elongation (after 28 days at +20°C and 50% R.H.):	DIN 53504 mod.	not required	30%
Static crack-bridging at -20°C after conditioning according to EN 1062-11 § 4.1 - 7 days at +70 °C:	EN 1062-7 Method A	from class A1 (0.1 mm) to class A5 (2.5 mm)	Class A3 (-20°C) (> 0.5 mm)

Dynamic crack-bridging at -20°C after conditioning according to EN 1062-11 § 4.1 - 7 days at +70 °C:	EN 1062-7 Method B	from class B1 to class B4.2	Class B3.2 (-20°C) no failure of test sample
Permeability to water vapour (wet-cup – method B) expressed as equivalent air thickness S_d :	EN ISO 7783	Class I $S_d < 5$ m Class II $5 \text{ m} \leq S_d \leq 50$ m Class III $S_d > 50$ m	$S_d = 2.1$ m Class I (permeability to water vapour)
Impermeability expressed as coefficient of permeability to liquid water W :	EN 1062-3	$W < 0.1 \text{ kg/m}^2 \cdot \text{h}^{0.5}$	$W < 0.02 \text{ kg/m}^2 \cdot \text{h}^{0.5}$ Class W_3 (low permeability to water) according to EN 1062-1
Permeability to carbon dioxide (CO ₂) – diffusion in equivalent air thickness S_D :	EN 1062-6 metodo B	$S_D > 50$ m	$S_D > 50$ m
Impact resistance of the Mapelastix Guard Zero film reinforced with Mapenet 150:	EN 12691	not required	700 mm
Reaction to fire:	EN 13501-1	Euroclass	E

WARNING

Although the technical details and recommendations contained in this product data sheet correspond to the best of our knowledge and experience, all the above information must, in every case, be taken as merely indicative and subject to confirmation after long-term practical application; for this reason, anyone who intends to use the product must ensure beforehand that it is suitable for the envisaged application. In every case, the user alone is fully responsible for any consequences deriving from the use of the product. The values declared in the TECHNICAL DATA table (typical values) were obtained in compliance with test methods and curing cycles defined in the technical standards referenced therein. Therefore, please note that the use of test procedures or methods other than those indicated in the table could lead to different values and that, in such cases, any liability of our company is excluded.

Please refer to the current version of the Technical Data Sheet, available from our website www.mapei.co.uk.

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The most up-to-date TDS can be downloaded from our website www.mapei.co.uk.

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